Accelerator Physics Homework #5

1. (CORRECTED!!) A proton beam of 1 GeV kinetic energy is injected into a synchrotron storage ring. It’s found that all protons with a normalized emittance (total) greater than 10 -mm-mr are lost. This is interpreted as being due to a resonance caused by a sextupole imperfection, and correctors are installed to compensate for it. Just worrying about the horizontal plane for now, the phase advance in each FODO cell is 95**°**, the tune is 7.7, and the maximum beta is 25m.
   1. I install one sextupole corrector in the high beta region of one cell. How many cells away (minimum) would I install a second corrector to most effectively cancel an arbitrary sextupole imperfection in the lattice?
   2. If the sextupole correctors are 20 cm long, what is the lowest maximum sextupole field B’’ each must be capable of to be sure of canceling the effect of the imperfection?
2. A curved solenoid is used to transport negative muons with kinetic energy of 25 MeV around a 90-degree bend.   
      
     
   Assuming that the bend radius is *R*=2m and the magnetic field along the axis of the solenoid is *B0*=2T, how far will the muons have drifted when they exit the solenoid? Do they drift in or out of the page in this representation? You may assume the muons are traveling mostly forward; that is, the transverse component of their velocity is negligible compared to the parallel component.
3. Show that if a quadrupole is rotated is rotated by an angle (positive rotation about axis out of the page), the resulting field will be

